AD-A044 779 FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO F/G 12/1
ASYMPTOTIC EFFECTIVENESS OF GENERALIZED V-FILTERS, (U)
MAR 77 V T DOLGOCHUB, M B SVERDLIK
UNCLASSIFIED FTD-ID(RS)I-0392-77 NL

| OF |
AD
A044779

END
DATE
FILMED
10 -77
DDC

AD-A044 779

FTD-ID(RS)I-0392-77

1

FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

ASYMPTOTIC EFFECTIVENESS OF GENERALIZED V-FILTERS

by

V. T. Dolgochub, M. B. Sverdlik

FOREIGN TECHNOLOGY DIVISION

Approved for public release;
distribution unlimited.

ACCESSION for
NTIS White Section
DDC Buff Section
UNANNOUNCED
JUSTIFICATION
BY
DISTRIBUTION/AVAILABILITY CODES
Dist. AVAIL. and/or SPECIAL
A

FTD ID(RS)I-0392-77

EDITED TRANSLATION

FTD-ID(RS)I-0392-77 30 March 1977

FTD-77-C-000314

CSI73016983

ASYMPTOTIC EFFECTIVENESS OF GENERALIZED V-FILTERS

By: V. T. Dolgochub, M. B. Sverdlik

English pages: 6

Source: Izvestiya Vysshikh Uchebnykh Zavedeniy Radioelektronika, Vol 15, NR 11, November 1972, PP. 1400-1401.

Country of origin: USSR
Translated by: Carol S. Nack
Requester: DRDMI/YDL
Approved for public release; distribution unlimited.

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.	PREPARED BY: TRANSLATION DIVISION FOREIGN TECHNOLOGY DIVISION WP-AFB, OHIO.

U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*<u>ye</u> initially, after vowels, and after ъ, ь; <u>e</u> elsewhere. When written as ё in Russian, transliterate as yё or ё. The use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

GREEK ALPHABET

Alpha	Α	α	α		Nu	Ν	ν	
Beta	Β	β			Xi	Ξ	ξ	
Gamma	Γ	γ			Omicron	Ο	ο	
Delta	Δ	δ			Pi	Π	π	
Epsilon	Ε	ε	ϵ		Rho	Ρ	ρ	ϱ
Zeta	Ζ	ζ			Sigma	Σ	σ	ς
Eta	Η	η			Tau	Τ	τ	
Theta	Θ	θ	ϑ		Upsilon	Τ	υ	
Iota	Ι	ι			Phi	Φ	φ	ϕ
Kappa	Κ	ϰ	κ	ϰ	Chi	Χ	χ	
Lambda	Λ	λ			Psi	Ψ	ψ	
Mu	Μ	μ			Omega	Ω	ω	

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English
sin	sin
cos	cos
tg	tan
ctg	cot
sec	sec
cosec	csc
sh	sinh
ch	cosh
th	tanh
cth	coth
sch	sech
csch	csch
arc sin	$\sin^{-1}$
arc cos	$\cos^{-1}$
arc tg	$\tan^{-1}$
arc ctg	$\cot^{-1}$
arc sec	$\sec^{-1}$
arc cosec	$\csc^{-1}$
arc sh	$\sinh^{-1}$
arc ch	$\cosh^{-1}$
arc th	$\tanh^{-1}$
arc cth	$\coth^{-1}$
arc sch	sech^{-1}
arc csch	csch^{-1}
rot	curl
lg	log

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

ASYMPTOTIC EFFECTIVENESS OF GENERALIZED V-FILTERS

V. T. Dolgochub and M. B. Sverdlik

A method of synthesizing filters which maximize the ratio (σ) of the square of the peak modulus to the sum of the squares of the side lobe moduli in a certain range of the reciprocal ambiguity function was proposed in [1]. One version of the realization of these filters, called generalized V-filters, consists of a delay line (DL) [Л3] with leads to which complex weighting factors are connected. The duration ($T_ф$) of the filter's pulse response can be equal to or greater than the signal length (T_c), while the intervals between the leads ($\tau_н$) are equal to or shorter than the discrete ($\tau_д$) signal length. The smoothing filter at the outlet of the DL is matched with interval $\tau_н$.

Report [1] showed that parameter σ is the nondecreasing function of ratio T_Φ/T_c. The analysis of the output signals of the calculated filters showed that parameter σ essentially increases with the increase in T_Φ/T_c; parameter μ (the ratio of the peak to the maximum side loop) also increases simultaneously, while ρ (the normalized signal/noise ratio) decreases. The main peak narrows and parameters δ, μ and ρ decrease as interval τ_H decreases.

It is convenient to estimate the asymptotic efficiency of generalized ν-filters by comparing them with the well-known Mosk and Urkovits filters.

Theoretically, this filter [2] makes it possible to suppress the side lobes of the output signal to the zero level (here $\delta = \infty$, $\mu = \infty$). However, the pulse response of this filter cannot be realized. In view of the behavior of parameters σ and μ, we can assume that ν-filters asymptotically approximate Mosk filters at $\tau_H = \tau_A$ and with the increase in ratio T_Φ/T_c. To confirm this assumption, we calculated the root-mean-square deviation ε of the frequency characteristics of generalized ν-filters from those of the Mosk filter. Figure 1 shows the dependence of ε on T_Φ/T_c for a 15-position biphase signal. The curve shows that the value of ε actually decreases with the increase in T_Φ/T_c; at $T_\Phi/T_c=3$ the value of ε is already forty times smaller than that of ε at

$T_\Phi/T_c=1$. At $T_\Phi/T_c=3$ the parameters of the output signal from the generalized √-filter assume the values σ = 177, μ = 28, ρ = 0.78.

Thus, it follows that the asymptotic estimate of parameter ρ of a generalized √-filter is determined by the value of parameter ρ of the Mosk filter. For the example in question, the asymptotic value of $\rho_{асим}\approx 0{,}66$.

Thus, generalized √-filters with controlled pulse response time make it possible to realize virtually any approximation of Mosk filters.

The frequency characteristic $\Phi(j\omega)$ of the well-known Urkovits filters is defined as [3]

$$\Phi(j\omega)=S^*(j\omega)/|S(j\omega)|^2,$$

where S(jω) is the signal spectrum.

It is obvious that with this form of the frequency characteristic and infinite widening of the spectrum, the output signal is a delta function, while parameters $\sigma=\infty$, $\mu=\infty$, $\rho=0$.

Urkovits filters are optimum for isolating signals against a background of reflections off local objects; however, they cannot be

realized in practice.

Since the passband of a generalized V-filter widens with the decrease in interval τ_{H}, the duration of the output signal peak decreases, which makes it logical to assume that generalized V-filters approximate Urkovits filters during asymptotic widening of the passband $(\tau_{H} \rightarrow 0)$. Indeed, the analysis of the frequency characteristics confirms this hypothesis.

The comparison with Urkovits filters was made in the area under the frequency characteristics in sections $0 \leqslant f_1 < 1/\tau_Д,\ 1/\tau_Д < f_2 < 2/\tau_Д,\ 2/\tau_Д < f_3 < 3/\tau_Д.$

Figure 2 shows graphs of the redistribution of area depending on the interval τ_{H} at $T_{\Phi} = T_c$. As the graphs indicate, the nature of the redistribution indicates the approximation of the generalized V-filters to the Urkovits filter.

However, we must keep in mind that widening the passband of generalized V-filters at $T_{\Phi} = T_c$ causes an increase in the side lobe level. Therefore, it is necessary to increase ratio T_{Φ}/T_c in order to decrease the side lobe level.

Thus, we can say that generalized V-filters asymptotically

approximate Urkovits filters with the increase in ratio T_{Φ}/T_c **and** widening of the passband; therefore, they can be considered to be the practical realization of the approximation of Urkovits filters with controlled memory and passband.

Received 29 1971

Bibliography

1. Долгочуб В. Т., Свердлик М. Б., Обобщенные ν-фильтры, Радиотехника и электроника, 1970, 15, № 1.

2. Mosca E., Sidelobe reduction in phase—coded pulse compression radars, IEEE Trans., Jan., 1967, IT.

3. Урковиц Г., Фильтр для обнаружения слабых радиолокационных сигналов на фоне мешающих отражений, Вопросы радиолокационной техники, 1954, № 2.

Fig. 1. Root-mean-square deviation of frequency characteristics of generalized ν-filters and Mosk filter ($\tau_{н}=\tau_{д}$).

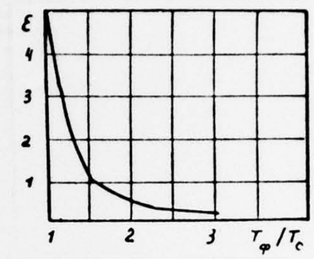
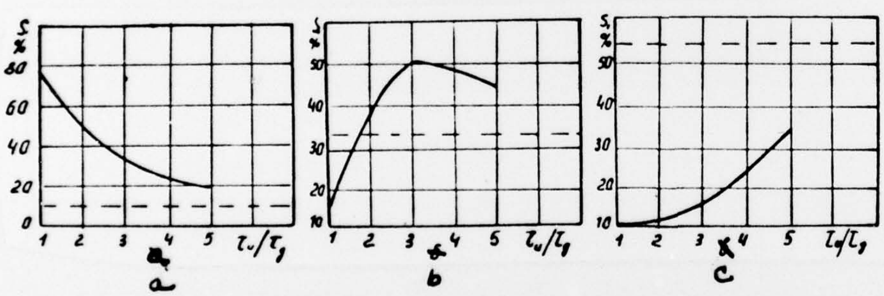


Fig. 2. Graphs of redistribution of area under frequency characteristics of generalized ν-filters ($T_{\Phi}=T_c$, , the broken line shows the area of the corresponding section for the Urkovits filter): a, b, c - sections f_1, f_2 and f_3, respectively.



UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER FTD-ID(RS)I-0392-77	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ASYMPTOTIC EFFECTIVENESS OF GENERALIZED V-FILTERS		5. TYPE OF REPORT & PERIOD COVERED Translation 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) V. T. Dolgochub, M. B. Sverdlik		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Foreign Technology Division Air Force Systems Command U. S. Air Force		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE November 1972 13. NUMBER OF PAGES 6
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

09

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DISTRIBUTION LIST

DISTRIBUTION DIRECT TO RECIPIENT

ORGANIZATION	MICROFICHE
A205 DMATC	1
A210 DMAAC	2
B344 DIA/RDS-3C	8
C043 USAMIIA	1
C509 BALLISTIC RES LABS	1
C510 AIR MOBILITY R&D LAB/FIO	1
C513 PICATINNY ARSENAL	1
C535 AVIATION SYS COMD	1
C557 USAIIC	1
C591 FSTC	5
C619 MIA REDSTONE	1
D008 NISC	1
H300 USAICE (USAREUR)	1
P005 ERDA	2
P055 CIA/CRS/ADD/SD	1
NAVORDSTA (50L)	1
NAVWPNSCEN (Code 121)	1
NASA/KSI	1
544 IES/RDPO	1
AFIT/LD	1

ORGANIZATION	MICROFICHE
E053 AF/INAKA	1
E017 AF/ RDXTR-W	1
E404 AEDC	1
E408 AFWL	1
E410 ADTC	1
E413 ESD	2
FTD	
CCN	1
ETID	3
NIA/PHS	1
NICD	5